

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

REC'D 17 NOV 2005

WIPO

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Applicant's or agent's file reference
11321-P066WO

FOR FURTHER ACTION

See Form PCT/IPEA/416

International application No.
PCT/US2004/019188

International filing date (day/month/year)
16.04.2004

Priority date (day/month/year)
16.06.2003

International Patent Classification (IPC) or national classification and IPC
B29B15/10, D06M15/55, D06M13/11, D06M13/196, D06M11/52, D06M11/09, C08K9/04, C08K7/24, C09K9/02, C01B31/02

Applicant

WILLIAM MARSH RICE UNIVERSITY

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 9 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:
 - a. ☐ sent to the applicant and to the International Bureau a total of sheets, as follows:
 - ☐ sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
 - ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.
 - b. ☐ (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).

4. This report contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☒ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☒ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☒ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☐ Box No. VIII Certain observations on the international application

Date of submission of the demand

10.01.2005

Date of completion of this report

18.11.2005

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Box No. I Basis of the report

1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.
- ☐ This report is based on translations from the original language into the following language, which is the language of a translation furnished for the purposes of:
- ☐ international search (under Rules 12.3 and 23.1(b))
 - ☐ publication of the international application (under Rule 12.4)
 - ☐ international preliminary examination (under Rules 55.2 and/or 55.3)
2. With regard to the **elements*** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

Description, Pages

1-42 as originally filed

Claims, Numbers

1-11, 14-51-54-72 as originally filed

Drawings, Sheets

1/18-18/18 as originally filed

- ☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing
3. ☐ The amendments have resulted in the cancellation of:
- ☐ the description, pages
 - ☐ the claims, Nos.
 - ☐ the drawings, sheets/figs
 - ☐ the sequence listing (*specify*):
 - ☐ any table(s) related to sequence listing (*specify*):
4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
- ☐ the description, pages
 - ☐ the claims, Nos.
 - ☐ the drawings, sheets/figs
 - ☐ the sequence listing (*specify*):
 - ☐ any table(s) related to sequence listing (*specify*):

* If item 4 applies, some or all of these sheets may be marked "superseded."

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Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability

1. The questions whether the claimed invention appears to be novel, to involve an inventive step (to be non-obvious), or to be industrially applicable have not been examined in respect of:
- ☐ the entire international application,
 - ☒ claims Nos. 12,13,52,53
because:
 - ☐ the said international application, or the said claims Nos. relate to the following subject matter which does not require an international preliminary examination (specify):
 - ☐ the description, claims or drawings (*indicate particular elements below*) or said claims Nos. are so unclear that no meaningful opinion could be formed (*specify*):
 - ☐ the claims, or said claims Nos. are so inadequately supported by the description that no meaningful opinion could be formed.
 - ☒ no international search report has been established for the said claims Nos. 12,13,52,53
 - ☐ the nucleotide and/or amino acid sequence listing does not comply with the standard provided for in Annex C of the Administrative Instructions in that:
 - the written form
 - ☐ has not been furnished
 - ☐ does not comply with the standard
 - the computer readable form
 - ☐ has not been furnished
 - ☐ does not comply with the standard
 - ☐ the tables related to the nucleotide and/or amino acid sequence listing, if in computer readable form only, do not comply with the technical requirements provided for in Annex C-*bis* of the Administrative Instructions.
 - ☐ See separate sheet for further details

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Box No. IV Lack of unity of invention

1. ☒ In response to the invitation to restrict or pay additional fees, the applicant has:
- ☐ restricted the claims.
 - ☐ paid additional fees.
 - ☐ paid additional fees under protest.
 - ☒ neither restricted nor paid additional fees.
2. ☐ This Authority found that the requirement of unity of invention is not complied with and chose, according to Rule 68.1, not to invite the applicant to restrict or pay additional fees.
3. This Authority considers that the requirement of unity of invention in accordance with Rules 13.1, 13.2 and 13.3 is
- ☐ complied with.
 - ☒ not complied with for the following reasons:
see separate sheet
4. Consequently, this report has been established in respect of the following parts of the international application:
- ☐ all parts.
 - ☒ the parts relating to claims Nos. 1-11,14-51,54-72 .

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes: Claims	1-39,50,51,54-65,71,72
	No: Claims	40-49,66-70
Inventive step (IS)	Yes: Claims	1-39,54-65,72
	No: Claims	40-51,66-71
Industrial applicability (IA)	Yes: Claims	1-11,14-51,54-72
	No: Claims	

2. Citations and explanations (Rule 70.7):

see separate sheet

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Box No. VI Certain documents cited

1. Certain published documents (Rule 70.10)
 and /or
2. Non-written disclosures (Rule 70.9)
 see separate sheet

Re Item IV.

1 UNITY

This Authority considers that there are 2 inventions covered by the claims indicated as follows:

- I: Claims 1-72 directed to composite materials comprising functionalised carbon nanotubes integrated into an epoxy resin matrix and to a method for producing said composites.
- II: Claims 73-90 directed to composite materials comprising carbon nanotubes, a fibrous material and a polymer matrix, and to a method for producing said composites.

The reasons for which the inventions are not so linked as to form a single general inventive concept, as required by Rule 13.1 PCT, are as follows:

The single general concept underlying all the independent claims of the present application is the production of composite materials comprising carbon nanotubes and a polymeric matrix.

This concept is not new (cf. e.g. **WO 02/060812, examples 19-25**).

The following technical feature of claims 1-72 makes a contribution over the prior art and can be considered as special technical feature within the meaning of Rule 13.2 PCT: the polymeric matrix is an epoxy resin.

The problem solved by these special technical features can be construed as to provide composite materials with high strength and reduced weight.

The following technical feature of claims 73-90 makes a contribution over the prior art and can be considered as a special technical feature within the meaning of Rule 13.2 PCT: the composite material further comprises a fibrous material.

The problem solved by this special technical feature can be construed as to provide fiber-reinforced composite materials comprising carbon nanotubes.

Also, examining the possible correspondence by technical effect, one finds that the

technical effect of the first invention is an increase in the strength and reduction in weight of the composite material and that the technical effect of the second invention is that fiber-reinforced composite materials comprising carbon nanotubes are produced.

This appears to show lack of corresponding technical effect as well. Consequently, neither the objective problem underlying the subjects of the claimed inventions, nor their solutions defined by the special technical features allow for a relationship to be established between the said inventions, which involves a single general inventive concept.

In conclusion, the groups of claims are not linked by common or corresponding special technical features and define two different inventions not linked by a single general inventive concept.

The application, hence does not meet the requirements of unity of invention as defined in Rules 13.1 and 13.2 PCT.

Re Item V.

- 2 Reference is made to the following document:
D1: WO 02/060812 (WILLIAM MARSH RICE UNIV.) - 8 August 2002

3 INDEPENDENT CLAIM 1

Document **D1**, which is considered to represent the most relevant state of the art, discloses (cf. **page 18, line 27 - page 20, line 14** and **examples 19-25**) a method from which the subject-matter of claim 1 differs in that the carbon nanotubes are dispersed in a solvent before mixing with the epoxy resin.

The subject-matter of claim 1 is therefore novel (Article 33(2) PCT).

The problem to be solved by the present invention may be regarded as to find alternative methods for producing CNT-epoxy composite materials.

The solution to this problem proposed in claim 1 of the present application is considered

as involving an inventive step (Article 33(3) PCT) for the following reasons: the cited documents only disclose methods wherein the nanotubes are directly mixed with the resin, or resin precursor. There is no incentive which would lead a person skilled in the art to the method of present claim 1, regardless of the possible advantages achieved thereby.

4 DEPENDENT CLAIMS 2-11 AND 14-39

Claims 2-11 and 14-39 are dependent on claim 1 and as such also meet the requirements of the PCT with respect to novelty and inventive step.

5 INDEPENDENT CLAIM 40

The present application does not meet the criteria of Article 33(1) PCT, because the subject-matter of claim 40 is not new in the sense of Article 33(2) PCT.

5.1 Claim 40 defines a product in terms of the process by which the product is made. According to the PCT International Search and Preliminary Examination Guidelines (PCT/GL/ISPE/1), section 5.26, such a claim is considered to lack novelty if a prior art product appears to be inherently the same, even if that product had been produced by means of a different process.

5.2 Document **D1** discloses (cf. **page 19, lines 6-32, and figure 17**) composite materials comprising carbon nanotubes dispersed and integrated into an epoxy matrix. Although a different method is used for the production of said composites, no difference can be seen in the product as such. For the reason explained in section 5.1, the subject-matter of claim 40 cannot be considered as novel.

6 DEPENDENT CLAIMS 41-51, 66-71

Dependent claims 41-51 and 66-71 do not contain any features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT in respect of novelty and/or inventive step (Article 33(2) and (3) PCT).

7 DEPENDENT CLAIMS 54-65, 72

The combination of the features of dependent claims 54-65 and 72 are neither known from, nor rendered obvious by, the available prior art. The reasons are as follows: none

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of the cited documents discloses, nor fairly suggests, to produce composite materials comprising carbon nanotubes and an epoxy resin, wherein the nanotubes carry carboxyl groups on their ends or sidewalls, or wherein the composite further comprises a fibrous substrate.